



NORTHWESTERN UNIVERSITY
CENTER FOR PUBLIC SAFETY

Traffic Crash Investigation Division
Core Course Overview

Traffic Crash Investigation 1

An 80-Hour Course

In most jurisdictions, traffic crashes account for more lives lost, more injuries and more property damage than all criminal activity combined. To effectively implement crash prevention programs and improve quality of life, law enforcement agencies need to know the who, what, where, when and why of crash occurrence. The moments immediately following a traffic crash are crucial, and only a well-trained crash investigator knows how to identify and collect the necessary information at the crash scene and to begin the interpretation of that evidence.

Crash investigators must work quickly and confidently to preserve significant physical results before the crash scene is altered or evidence disappears. They must anticipate what information will be needed for enforcing traffic laws, planning crash prevention programs and possible case litigation. In addition, they must properly document the at-scene information and evidence because once the scene is cleared, the evidence might be impossible to recover.

Crash Investigation 1, based on J. Stannard Baker and Lynn Fricke's world-renowned text, *Traffic Crash Investigation*, is an in-depth study of the skills needed to systematically investigate a traffic crash.

Techniques for recognizing and properly recording roadway and vehicle crash evidence are thoroughly presented. Students learn to take measurements and photographs of the crash scene and to create sketches and after-crash diagrams. Crash Investigation 1 also addresses how the collected data are used to reconstruct crashes. Finally, the use of electronic devices to collect and record at-scene data is also introduced.

Course Content

- Preparation for traffic crash investigation
- Information from and about people
- Information from vehicles
- Information from roads
- Measuring and mapping the crash scene
- Photographing the crash scene and damaged vehicles
- For this updated program, students will develop a new case study. Photographs and exhibits have been updated, and classroom instruction now includes how the latest generation of vehicle electronics - including data recorders, traction and stability controls, multiple airbags, etc. - affect both the crash and the crash investigation

Course Outcomes

Officers/investigators who successfully complete Crash Investigation 1 significantly improve their ability to handle all aspects of the majority of traffic crash investigations occurring within their jurisdictions.

Participants who successfully complete Crash Investigation 1 or its equivalent are eligible to enroll in NUCPS's next crash investigation course, Crash Investigation 2.

Traffic Crash Investigation 2

An 80-Hour Course

At scene traffic crash data collection is useful only if all appropriate information is collected and properly interpreted and analyzed. Participation in Crash Investigation 2 enhances the capability and credibility of the at-scene investigator. Crash Investigation 2, based on the 2014 edition of J. Stannard Baker and Lynn Fricke's world-renowned textbook, *Traffic Crash Investigation*, emphasizes vehicle behavior in crashes, vehicle damage analysis and more advanced mapping and evidence location skills.

Crash Investigation 2 builds upon topics examined in Crash Investigation 1 and provides the student/investigator with greater knowledge of the information available at the crash scene and how to properly collect and initiate interpretation of that information. The course also provides instruction in the use of laser-based measurement devices to measure crash scenes and the evidence found there. Laser Technology, Inc. units are used for these demonstrations. Downloading the electronic information into mapping programs is also covered.

Course Content

- Vehicle damage analysis - description, reporting and determination of direction of forces
- Vehicle behavior in crashes
- Results of the crash on the road - identifying and interpreting tire marks and road scars
- Lamp filament analysis - determining whether headlamps, tail lights and turn signals were on or off at moment of impact
- Tire damage analysis - role of tire failure
- Measurement methods - perspective grid, photogrammetry, measurement techniques, diagram drawing and systematic methods for organizing and illustrating data
- Interpretation of data - use of all information obtained through investigation
- Specialized data gathering - measuring devices and other testing
- Laser-based measurement and use of mapping software
- In addition to addressing how the latest generation of vehicle electronics - including data recorders, traction and stability controls, multiple airbags - affect both the crash and the crash investigation, specific new topics include:
 - hit-and-run investigations,
 - dealing with event data recorders
 - technical report writing and other emerging technologies

Course Outcomes

Officers/investigators who successfully complete Crash Investigation 2 develop skills in technically preparing crash investigation data and collecting follow-up data required by prosecutors, defense attorneys, claim adjusters, fleet supervisors, reconstructionists and highway safety engineers.

Vehicle Dynamics

A 40-Hour Course

Dynamics is the branch of mechanics that deals with the motion of bodies and the action of forces in producing or changing that motion. Vehicle dynamics covers the dynamics relating to objects involved in traffic crashes.

One of the key objectives of Vehicle Dynamics is to teach students the classical mechanics equations of motion. The relationship of drag factor, coefficient of friction and acceleration are presented. Students are introduced to the methodology used to estimate vehicle speeds based on flips, vaults and sideslip. Students are also taught the differences between force, momentum and energy and how each applies to crash investigation and reconstruction.

Course Content

- Newton's laws of motion
- Coefficient of friction and drag factor
- Introduction to basic motion equations - velocity, time, acceleration and distance
- Speed estimates using flip/vault, fall and sideslip equations
- Momentum - collinear (in-line)
- Energy - energy and skidding, kinetic energy and velocity estimates
- Speed estimates from irregular skidmarks

Who Should Attend

This course provides an introduction to basic mathematical procedures and the basic laws of physics necessary for those who wish to attend Traffic Crash Reconstruction 1 and Traffic Crash Reconstruction 2. Students planning to attend Vehicle Dynamics should have satisfactorily completed Crash Investigation 1 and Crash Investigation 2.

In addition, Vehicle Dynamics involves a considerable amount of physics and mathematics. Prospective students should have successfully completed a high school physics course as well as high school-level algebra, geometry and trigonometry.

Course Outcomes

After successfully completing this course, students will have knowledge of the basic mathematical procedures and the basic laws of physics necessary for attending Traffic Crash Reconstruction 1 and 2.

Traffic Crash Reconstruction 1

An 80-Hour Course
(80 ACTAR CEUs)

Traffic Crash Reconstruction 1 is based on the greatly expanded text by Lynn Fricke, *Traffic Crash Reconstruction*. In Traffic Crash Reconstruction 1, students utilize the information learned in Crash Investigation 1 and 2, as well as Vehicle Dynamics, to begin developing an understanding on how a crash occurred. The course focuses on analyzing and interpreting information that has been collected at lower levels of investigation in order to describe the crash and the events leading to actual impact in as much detail as possible.

During Reconstruction 1, students will apply the knowledge learned in lecture daily with a real-world case study situation. This format of learning provides students with the training necessary to successfully reconstruct traffic crashes.

Traffic Crash Reconstruction 1 course content includes:

- Engineering Mechanics
- Vehicle Behavior in Collisions
- Introduction to Human Factors
- Time-Distance Analysis
- Conservation of Momentum
- EDR Usage in Traffic Crash Reconstruction
- Post-Collision Drag Factor
- Basic Equations of Motion
- Newton's Laws of Motion
- Collinear collisions
- Oblique collisions
- Opposite-direction collision
- Same-direction collision
- Single-vehicle collision
- Marks on the road
- Driver strategy and tactics
- Eight Real-World Case Studies

Traffic Crash Reconstruction 2

An 80-Hour Course
(80 ACTAR CEUs)

Completely Updated Material

Traffic Crash Reconstruction 2 further explores the methods for reconstructing traffic crashes and also uses as a text the 2010 edition of Traffic Crash Reconstruction by Lynn B. Fricke.

This course provides additional training, through lectures and course material and focuses on an energy analysis. This course also provides students with daily real-world case studies to tie lecture learned knowledge to hands-on analysis.

Traffic Crash Reconstruction 2 course content includes:

- Work and Energy
- Damage Energy
- Energy and Momentum
- Force Balance
- After-Impact Drag Factors
- Occupant Kinematics
- Light Vehicle Event Data Recorder Usage in Traffic Crash Reconstruction
- Heavy Vehicle Event Data Recorder Usage in Traffic Crash Reconstruction
- Special Velocities – Sideslip, Falls, Vaults, Flips
- Monte Carlo Statistical Analysis

Who Should Attend:

Traffic Crash Reconstruction 2 is designed with traffic reconstructionists in mind. Participants must possess the skills learned during NUCPS's Crash Investigation 1, Crash Investigation 2, Vehicle Dynamics and Traffic Crash Reconstruction 1 (or equivalent crash investigation courses with prior approval from NUCPS staff). These skills include the ability to prepare after-crash situation maps, classify and interpret vehicle damage, properly interpret marks on the road and a proficiency in algebra and basic physics.

**NORTHWESTERN UNIVERSITY
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CRASH INVESTIGATION 1

Course Outline & Schedule

CRASH INVESTIGATION 1

COURSE OBJECTIVES

The specific objectives of this training program are to enable investigators to:

1. Identify, record, and describe the damage to a vehicle resulting from a traffic crash.
2. Estimate the coefficient of friction at the scene of a traffic crash, estimate stopping distances, and perform simple (no impact) slide to stop speed estimates based on skid marks.
3. Know those limitations and responsibilities under the law that impact upon his/her duties in responding to and investigating a traffic crash.
4. Have a clear understanding of how a person can obtain useful information from people about how a traffic crash occurred.
5. Identify, define, and explain the significance of information from the roadway.
6. Explain the role that the traffic crash investigator plays within the police mission of traffic safety, know the five levels of crash investigation, know how to plan the different stages of the traffic crash investigation, be able to properly define key points in the sequence of a traffic crash, and be able to define the elements necessary to classify an incident other than strictly a traffic crash, such as a leaving the scene, suicide, or murder.
7. Identify, measure and record the results of a crash. The student should also be able to measure, record information about the road, and be able to draw simple after crash working and display maps.
8. Have a clear understanding of how to take photographs at the crash scene that will accurately record information relative to the crash. The student will also have a clear understanding of the basic equipment needed to photograph the crash site and the vehicles involved.

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CRASH INVESTIGATION 1

General Instructions

The assignments referred to throughout the program of instruction are minimum requirements for successful completion of the course.

Much of the student's work will, in itself, become a part of the reference manual. You are urged to complete projects and assignments on time. You are asked to present your material in such a manner as to make it acceptable as future reference material for your use.

You will be expected to correlate class schedules with advance study, review and reading assignments.

The specific assignments referred to and the degree of your participation in using the reference material is outlined as follows:

Review	Make a general survey of the subject material and the major elements of the principles involved.
Read	Read the reference material in its entirety to become familiar with the subject matter in order to gain a general background and knowledge of the subject.
Study	Read and examine in detail to gain a thorough and working knowledge of the subject content.
Notes	Write your responses or answers to the "study and discussion questions" on the sheets provided, or on supplemental paper (which you may be required to submit at the conclusion of the discussion period) to assist you in crystallizing your thinking and in aiding you in classroom discussions.
Use	To be used either in the classroom or on homework assignments in accordance with the direction of the unit instructor or as indicated by the instruction on the material to be used.

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

CRASH INVESTIGATION 1

Course Content

TAB	SUBJECT	HRS
1	Registration & Orientation	1.0
2	Introduction to Crash Investigation	3.0
3	Traffic Crash Information From and about People	3.0
4	Photography For Traffic Crash Investigation	5.0
5	Traffic Crash Information From Roads	9.0
6	Traffic Crash Information From Vehicles	5.0
7	Measuring At The Scenes of Traffic Crashes and Drawing After-Collision Situation Maps	17.0
8	Simple Estimates of Vehicle Stopping Distances and Speed From Skidmarks	3.0
9	Field Project Instruction	1.0
	Field Projects and Project Reviews	11.0
10	Case Study	2.0
	Course Administration	20.0
	TOTAL (See note at bottom of page 7).	80.0

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

CRASH INVESTIGATION 1

Course Outline

1. Registration and Orientation 1.0 Hour

Objective: To acquaint the students with course operating procedures, to introduce them to the reference materials, course outline, course schedule and rules for student behavior. To define their responsibilities and obligations as students, in order that they will be able to make the maximum use of the instructional material that will be presented to and for them.

Reference	Ref. No.	Assignment
Course Outline & Schedule	Tab 1-1	Use
Course Questionnaire & Critique	Tab 1-2	Use
Student Responsibilities and Obligations	Tab 1-3	Review
Sexual Harassment	Tab 1-4	Review
Community Facilities	Tab 1-5	Review

2. Introduction to Crash Investigation 3.0 Hours

Objective: Given this course of instruction, the student should be able explain the role that the traffic crash investigator plays within the police mission of traffic safety, know the five levels of crash investigation, know how to plan the different stages of the traffic crash investigation, and be able to define the elements necessary to classify situations beyond a traffic crash, such as suicide, homicide, or leaving the scene.

Reference	Ref. No.	Assignment
Chapter 1	'TCI *'Study	
Introduction to Traffic Crash Investigation	Tab 2-1	Use
Introduction to Traffic Crash Investigation Study Questions	Tab 2-1	Use

* TCI is the *Traffic Crash Investigation* manual.

3. Traffic Crash Information From & About People

3.0 Hours

Objective: Given this course of instruction, the student should have a clear understanding of how a person can obtain useful information from people about how a traffic crash happened. The student should also be able to properly define key points in the sequence of a traffic crash.

Reference	Ref. No.	Assignment
Chapter 2	<i>TCI</i>	Study
Traffic Crash Information From & About Peop	Tab 3-1	Use
Traffic Crash Information From & About People Study Guide	Tab 3-2	Use
Statement Form	Tab 3-3	Review

4. Photography for Traffic Crash Investigation

5.0 Hours

Objective: Given this course of instruction, the student will have a clear understanding of how to take photographs at the crash site that will accurately record information relative to the crash. The student will also have a clear understanding of the basic equipment needed to photograph the crash site and the vehicles involved.

Reference	Ref. No.	Assignment
Chapter 8	<i>TCI</i>	Study
Photographing the Collision Scene & Damaged Vehicles – #1	Tab 4-1	Use
Photographing the Collision Scene & Damaged Vehicles – #2	Tab 4-2	Use
Photography Project Work	Tab 4-3	Use
Photography Review Quiz	Tab 4-5	Use

5. Traffic Collision Information from Roads

9.0 Hours

Objective: Given this course of instruction, the student should be able to identify, define, and explain the significance of information from the roadway.

Reference	Ref. No.	Assignment
Chapter 4	<i>TCI</i>	Study
Traffic Crash Information From Roads	Tab 5-1	Use
Student Study Questions – Information from Roads	Tab 5-2	Use
Quiz Review: Off the Ground and Condition Classification	Tab 5-3	Use
Quiz Review: Road Scars and Debris	Tab 5-4	Use
Quiz Review: Tire Marks	Tab 5-5	Use

6. Traffic Crash Information from Vehicles

5.0 Hours

Objective: Given this course of instruction, the student should be able to identify, define, and explain the significance of information from the vehicle.

Reference	Ref. No.	Assignment
Chapter 3	<i>TCI</i>	Study
Traffic Crash Information from Vehicles	Tab6-1	Use
Traffic Crash Information from Vehicles – Objective	Tab 6-2	Use
General Vehicle Examination Form – SN 8084	Tab 6-3	Use

7. Measuring at the Scenes of Traffic Collisions and Drawing After Collision Situation Maps

17.0 Hours

Objective: Given this course of instruction, the student should be able to identify, measure, and record the results of a crash. The student should also be able to measure, record information about the road, and be able to draw simple after collision working and display maps.

Reference	Ref.No.	Assignment
Chapters 5,6,7	<i>TCI</i>	Study
Measuring at the Scenes of Traffic Crashes (and Study Guide)	Tab 7-1& (7-2)	Use
Measuring the Road for After Collision Situation Maps/Project	Tab 7-3 & (7-4)	Use
Drawing After Collision Situation Maps (and Work Problems)	Tab 7-5 & (7-6)	Use
Measurement Data Forms	Tab 7-7	Use

8. Simple Estimates of Vehicle Stopping Distances and Speed from Skidmarks 3.0 Hours

Objective: Given this course of instruction, the student should be able to estimate the drag factor at the scene of a traffic crash, estimate stopping distances, and perform simple (no impact) slide to stop speed estimates based on skidmarks.

Reference	Ref. No.	Assignment
Simple Estimates of Vehicle Stopping Distances and Speed	Tab 8-1	Use
Study Guide Questions – Simple Estimates of Distance/Speed	Tab 8-2	Use
Problems – Simple Estimate of Distance/Speed	Tab 8-3	Use
Skid Mark Speed Nomograph and Stopping Distance Table	Tab 8-5	Use

9. Field Project(s) Instructions and Forms 1.0 Hours

10. Case Study 2.0 Hours

Objective: Given all of the previous courses of instruction, the student should be able to utilize the knowledge and skills acquired during the entire course to solve a simple problem utilizing data from an actual collision situation. The Case Study Method, which is used in more advanced CPS courses, is introduced.

NOTE: The last hour of each day is set aside for working on the Study and Discussion Questions and provides an opportunity to review the previous day's materials and prepare for upcoming lectures. Reading assignments, questions on quiz or exam materials, and other course issues can also be discussed with staff.

Crash Investigation 1

WEEK 1

Day	1st Hour	2nd Hour	3rd Hour	4th Hour		5th Hour	6th Hour	7th Hour	8th Hour
Monday	Registration	Introduction To Crash Investigation			L	Information From People			Reading and Review
Tuesday	Information From Roads				U	Information From Roads			Reading and Review
Wednesday	Information From Roads		At-Scene Measurments		N	At-Scene Measurments		Quiz 1	Reading and Review
Thursday	Quiz 1 Review	At-Scene Measurments			C	At-Scene Measurments	Measure and Drawing		Reading and Review
Friday	Exam 1		Measure and Drawing		H	Measure and Drawing		Exam Review	

Crash Investigation 1

WEEK 2

Day	1st Hour	2nd Hour	3rd Hour	4th Hour	L U N C H	5th Hour	6th Hour	7th Hour	8th Hour
Monday	Advanced Mapping			Site Measure Project		Site Measuring Project			Reading and Review
Tuesday	Photography					Photography	Information from Vehicles		Reading and Review
Wednesday	Information From Vehicles			Vehicle/Photo Projects		Vehicle and Photo Projects			Reading and Review
Thursday	Quiz 2	Simple Speed Estimates				Project Reviews			Reading and Review
Friday	Quiz 2 Review	Case Study		Final Exam		Final Exam		Review and Course Closing	

**NORTHWESTERN UNIVERSITY
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CRASH INVESTIGATION 2

Course Outline & Schedule

TRAFFIC CRASH INVESTIGATION 2

COURSE OBJECTIVES

The specific objectives of this training program are to enable investigators to:

1. Have a clear understanding of how abnormalities of lamps can indicate if the lamp was off or on at the time of the crash.
2. Measure and draw complex after-collision situation maps.
3. Understand the basic principles of photogrammetry that can be used to draw after collision situation maps.
4. Identify, describe, and explain the significance of information from the roadway.
5. Properly assess the need for addressing tire failure as an issue in a traffic crash, adequately document the condition of the tire(s) at the scene of the crash, and properly identify, describe, record, and explain the nature and cause of tire and wheel abnormalities.
6. Understand how vehicles behave in collisions and what procedures must be performed to recognize how vehicles react to collision forces.

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

CRASH INVESTIGATION 2

General Instructions

The assignments referred to throughout the program of instruction are minimum requirements for successful completion of the course.

Much of the student's work will, in itself, become a part of the reference manual. You are urged to complete projects and assignments on time. You are asked to present your material in such a manner as to make it acceptable as future reference material for your use.

You will be expected to correlate class schedules with advance study, review and reading assignments.

The specific assignments referred to and the degree of your participation in using the reference material is outlined as follows:

Review	Make a general survey of the subject material and the major elements of the principles involved.
Read	Read the reference material in its entirety to become familiar with the subject matter in order to gain a general background and knowledge of the subject.
Study	Read and examine in detail to gain a thorough and working knowledge of the subject content.
Notes	Write your responses or answers to the "study and discussion questions" on the sheets provided, or on supplemental paper (which you may be required to submit at the conclusion of the discussion period) to assist you in crystallizing your thinking and in aiding you in classroom discussions.
Use	To be used either in the classroom or on homework assignments in accordance with the direction of the unit instructor or as indicated by the instruction on the material to be used.

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

CRASH INVESTIGATION 2

Course Content

TAB	SUBJECT	HOURS
1	Registration & Orientation	1.0
2	Advanced Mapping	4.0
3	Tire Examination	4.0
4	Vehicle Damage Documentation	4.0
5	Vehicle Behavior in Collisions	11.0
6	Lamp Examination	7.0
7	Information From Roads Reviewed	2.0
8	Photogrammetry	3.0
9	Night Collision Photography	2.0
10	Introduction To Vehicle Dynamics	3.0
11	Case Study	2.0
12	Field Project Instruction	2.0
13	Field Projects	6.0
14	Project Review	13.0
15	Course Administration	16.0
	TOTAL	80.0

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

CRASH INVESTIGATION 2

Course Outline

1. Registration and Orientation 1.0 Hour

Objective: To acquaint the students with course operating procedures, to introduce them to the reference materials, course outline, course schedule and rules for student behavior. To define their responsibilities and obligations as students, in order that they will be able to make the maximum use of the instructional material that will be presented.

Reference	Ref. No.	Assignment
Course Outline & Schedule	Tab 1-1	Use
Course Questionnaire & Critique	Tab 1-2	Use
Student Responsibilities and Obligations	Tab 1-3	Review
Sexual Harassment	Tab 1-4	Review
Community Facilities	Tab 1-5	Review

2. Advanced Mapping 4.0 Hours

Objective: Given this course of instruction, students will be able to measure complex collision scenes and draw complex after-collision situation maps.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 5	Study
Review of Measurements for Collision Scene Investigation	Tab 2-1	Study
Advanced Mapping at Traffic Collision Scenes	Tab 2-2	Use
Advanced Mapping Problems	Tab 2-3	Use
Measurement Data Forms	Tab 2-4	Review

3. Tire Examination Following Crashes

4.0 Hours

Objective: Given this course of instruction, the student should be able to properly assess the need for addressing tire failure as an issue in a traffic crash, adequately document the condition of the tire(s) at the scene of the crash, and properly identify, describe, record, and explain the nature and cause of tire and wheel abnormalities.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 8	Study
Tire Examination After Motor Vehicle Collisions	Tab 3-1	Use
Tire Examination Student Study Questions	Tab 3-2	Use
General Vehicle Examination Form	Tab 3-4	Review
Tire and Wheel Examination Record	Tab 3-5	Review

4. Vehicle Damage Documentation

4.0 Hours

Objective: This module of instruction will enable the student to have the skills to adequately measure vehicle crush damage and to be able to describe the damage using the Collision Deformation Classification.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 3	Study
Measurements of Damaged Vehicles	Tab 4-1	Use
Collision Deformation Classification	Tab 4-2	Use
Collision Deformation Classification Problems	Tab 4-3	Use
General Vehicle Examination Form	Tab 4-4	Use
Vehicle Collision Damage Record	Tab 4-5	Use

5. Vehicle Behavior in Collisions 11.0 Hours

Objective: Given this course of instruction, the student should be able to explain how vehicles behave in collision and what procedure must be performed to accomplish this.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 10	Study
Vehicle Behavior in Collisions	Tab 5-1	Use
Project Work – Vehicle Behavior in Collisions	Tab 5-2	Use
Project Work Addendum (to be distributed in class)	Tab 5-3	Use

6. Lamp Examination 7.0 Hours

Objective: Given this course of instruction the student will have a clear understanding of how abnormalities of lamps can indicate if the lamp was off or on at the time of the crash.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 7	Study
Lamp Examination for Motor Vehicles	Tab 6-1	Use
Student Study Guide Questions	Tab 6-2	Use
Lamp Examination Record – SN 1122	Tab 6-3	Use

7. Traffic Crash Information from Roads Reviewed 2.0 Hours

Objective: Given this course of instruction, the student should be able to identify, describe, and explain the significance of information from the roadway.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 4	Study
Information from Roads	Tab 7-1	Review

8. Photogrammetry for Traffic Collision Investigation

3.0 Hours

Objective: Given this course of instruction, the student should be able to define and use the basic principles of photogrammetry to draw after collision situation maps and vehicle damage dimensions.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 9	Study
Photogrammetry for Collision Analysis	Tab 8-1	Review
Student Project Work	Tab 8-2	Use

9. Nighttime Photography

2.0 Hours

Objective: Given this course of instruction, the student should be able to photograph nighttime crashes.

Reference	Ref. No.	Assignment
<i>TCI</i>	Chapter 6	Review
Night Collision Photography	Tab 9-1	Use
Night Collision Photography Project	Tab 9-2	Use

10. Introduction To Vehicle Dynamics

3.0 Hours

Objective: Based on this instruction students should be able to determine vehicle speeds from skids and yaws using simple equations of motion.

Introduction to Vehicle Dynamics	Tab 10-1	Use
Practice Problems – Introduction to Vehicle Dynamics	Tab 10-2	Use

11. Case Study – Reconstruction 2.0 Hours

Objective: Given this course of instruction, the student will apply the principles learned previously to a real crash case study.

Reference	Ref. No.	Assignment
Case Study	Tab 11-1	Use

12. Field Project Instruction 2.0 Hour

Objective: Given this course of instruction, the student will have completed practical exercises assessing vehicle damage and advanced measuring techniques.

Reference	Ref. No.	Assignment
Vehicle Damage Field Work	Tab 12-1	Use
Measurement Field Work	Tab 12-2	Use
General Vehicle Examination Form	Tab 12-3	Use
Vehicle Collision Damage Record	Tab 12-4	Use

CRASH INVESTIGATION 2 Course Schedule

First Week

	1st Hour	2nd Hour	3rd Hour	4th Hour	L U N C H	5th Hour	6th Hour	7th Hour	8th Hour
Mon	Register	Night Photography		Tire Exam		Tire Examination			Project Review
Tue	Quiz 1	Vehicle Damage Documentation				Continue	Lamp Examination		Project Review
Wed	Lamp Examination					Continue	Road Review		Project Review
Thu	Quiz 2	Mapping				Quiz 3 – Lamps		Review	Project Review
Fri	Exam 1			Mapping		Intro to Vehicle Dynamics			

Second Week

	1st Hour	2nd Hour	3rd Hour	4th Hour	L U N C H	5th Hour	6th Hour	7th Hour	8th Hour
Mon	Review Exam	Vehicle Behavior in Collisions				Photogrammetry			Project Review
Tue	Vehicle Behavior in Collisions		Field Project Instruction			Field Project			Project Review
Wed	Quiz 4	Vehicle Behavior in Collisions				Field Project			Project Review
Thu	Review Quiz	Vehicle Behavior In Collisions				Project Review	Case Study		Project Review
Fri	Exam 2			Course		Closing			

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

VEHICLE DYNAMICS

Overview & Schedule

v20-1

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

VEHICLE DYNAMICS

Course Content

MODULE	SUBJECT	HOURS
1	Overview	1.0
2	Dynamics	12.0
3	Irregular Braking	2.5
4	Introduction to Momentum	7.0
5	Time-Distance Analysis	3.5
6	Problem Solutions	4.0
7	Case Study	4.0
	Quizzes and Final Exam	6.0
	<u>TOTAL HOURS</u>	<u>40.0</u>

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY

VEHICLE DYNAMICS

Course Outline

MODULE 1 - OVERVIEW

1.0 HOUR

Objective: To acquaint the students with course operating procedures, to introduce them to the reference materials, course outline, course schedule and rules for student behavior. To define their responsibilities and obligations as students, in order that they will be able to make the maximum use of the instructional material that will be presented to and for them.

Reference	Ref. No.	Assignment
Course Overview & Schedule	1-1	Review
Course Evaluation	1-2	Use
Equations	1-3	Use
Coefficient of Friction Table	1-4	Use
Vehicle Acceleration Table	1-5	Use
Imperial-Metric Conversions	1-6	Use
Basic Algebra	1-7	Review

MODULE 2 - DYNAMICS

11.0 HOURS

Objective: To teach the students the classical mechanics equations of motion. To familiarize the students with Newton's three laws of motion, and the relationships between drag factor, coefficient of friction and acceleration.

Reference	Ref. No.	Assignment
Dynamics	2-1	Study
Dynamics Problem - STATEMENTS	2-2	Use

MODULE 3 - IRREGULAR BRAKING

2.5 HOURS

Objective: To teach the students how to estimate the speed of a vehicle when irregular braking has occurred.

Reference	Ref. No.	Assignment
Irregular Braking	3-1	Study
Irregular Braking Problems - STATEMENTS	3-2	Use

MODULE 4 - INTRODUCTION TO MOMENTUM

7.0 HOURS

Objective: To introduce the concept of conservation of linear momentum. To enable the students to understand the data needed to do a collinear momentum analysis and to apply this technique for collision speed analysis.

Reference	Ref. No.	Assignment
Introduction to Momentum	4-1	Study
Introduction to Momentum Problems - STATEMENTS	4-2	Use

MODULE 5 - TIME-DISTANCE ANALYSIS

3.5 HOURS

Objective: To teach the students how to apply the equations of motion, introduced in the Dynamics section, to calculate the time and distance relationships between entities involved in traffic crashes.

Reference	Ref. No.	Assignment
Time-Distance Analysis	5-1	Study
Time-Distance Analysis Problems - STATEMENTS	5-2	Use/Notes

MODULE 6 - ASSIGNED PROBLEMS AND PROBLEM SOLUTIONS

4.0 HOURS

Objective: To provide the students with practice solving problems in the areas of instruction by applying the concepts taught.

Reference	Ref. No.	Assignment
Assigned Problems - STATEMENTS	6-1	Notes
Dynamics Problems - SOLUTIONS	6-2	Use/Notes
Irregular Braking Problems - SOLUTIONS	6-3	Use/Notes
Introduction to Momentum Problems - SOLUTIONS	6-4	Use/Notes
Time-Distance Analysis Problems - SOLUTIONS	6-5	Use/Notes

MODULE 7 - CASE STUDY

4.0 HOURS

Objective: To allow the students to apply the principles taught to a real-world case.

Reference	Ref. No.	Assignment
Case Study	7-1	Use

QUIZZES/FINAL EXAM

6.0 HOURS

Objective: To evaluate comprehension and performance. Two quizzes, assigned problems, and a comprehensive exam will be given. The students will be allowed to use their notes during the comprehensive exam.

Point Values

Quiz #1 - Dynamics 10 Questions - 1 Point each	10 points
Quiz #2 - Dynamic and Momentum 10 Questions - 1 Point each	10 points
Assigned Problems 10 Problems - 1 Point each	10 points
Final Examination Part 1 - 25 Questions - 1 Point each Part 2 - 15 Problems - 3 Points each	70 points
<u>Total</u>	<u>100 points</u>

REFERENCE CHAPTERS*Traffic Crash Reconstruction*

Chapter 3	-	Mathematics and Physics Review for Traffic Crash Reconstruction
Chapter 6	-	Drag Factor and Coefficient of Friction for Traffic Crash Reconstruction
Chapter 9	-	Momentum Applications in Traffic Crash Reconstruction
Chapter 16	-	Derivations of Equations for Traffic Crash Reconstruction

NORTHWESTERN UNIVERSITY CENTER FOR PUBLIC SAFETY
VEHICLE DYNAMICS

Schedule

MODULE		SUBJECT	HOURS
MONDAY			
1	8:00 - 9:00	Overview	1.0
2	9:00 - 12:00	Dynamics	3.0
2	1:00 - 5:00	Dynamics	4.0
TUESDAY			
2	8:00 - 12:00	Dynamics	4.0
2	1:00 - 2:00	Dynamics	1.0
3	2:00 - 4:30	Irregular Braking	2.5
	4:30 - 5:00	<u>Quiz #1</u> <u>Dynamics</u>	0.5
WEDNESDAY			
	-8:00 - 8:30	Review Quiz #1	0.5
4	8:30 - 12:00	Introduction to Momentum	3.5
4	1:00 - 4:30	Introduction to Momentum	3.5
	4:30 - 5:00	<u>Quiz #2</u> <u>Dynamics and Irregular Braking</u>	0.5
THURSDAY			
	8:00 - 8:30	Review Quiz #2	0.5
5	8:30 - 12:00	Time-Distance Analysis	3.5
6	1:00 - 5:00	Problem Solutions	4.0
FRIDAY			
7	8:30 - 12:00	Case Study	4.0
	1:00 - 5:00	<u>Final Exam</u>	4.0
<u>Comprehensive</u>			
<u>TOTAL HOURS</u>			<u>40.0</u>

**NORTHWESTERN UNIVERSITY
CENTER FOR PUBLIC SAFETY**

Traffic Crash Reconstruction 1

Course Outline & Schedule 1-1

v20-2

TRAFFIC CRASH RECONSTRUCTION 1

Course Content

MODULE	SUBJECT	HOURS
1	Overview	1.0
2	Introduction to Traffic Crash Reconstruction	1.0
3	Engineering Mechanics	12.5
4	Vehicle Behavior in Collisions	3.0
5	Introduction to Human Factors	1.0
6	Time-Distance Analysis	3.0
7	Comprehensive Problems	5.0
8	Case Studies and Case Study Reviews	15.0
9	After-Impact Drag Factor	7.0
10	Momentum	12.5
11	Problem Solutions	0.0
-	Quizzes and Exams	19.0

TOTAL HOURS **80.0**

TRAFFIC CRASH RECONSTRUCTION 1

Course Outline

MODULE 1 - OVERVIEW	1.0 HOUR
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Objective: To acquaint the students with course operating procedures, to introduce them to the reference materials, course outline, course schedule and rules for student behavior. To define their responsibilities and obligations as students.

Reference	Ref. No.	Assignment
Course Overview - Outline & Schedule	1-1	Review/Use
Traffic Crash Reconstruction Equations	1-2	Use
Traffic Crash Reconstruction Equations and Variables	1-3	Use
Coefficient of Friction Table	1-4	Use
Vehicle Acceleration Table	1-5	Use
Imperial-Metric Conversions	1-6	Use
Basic Algebra (NOT covered in class)	1-7	Review
Basic Trigonometry (NOT covered in class)	1-8	Review

MODULE 2 - INTRODUCTION TO TRAFFIC CRASH RECONSTRUCTION	1.0 HOUR
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Objective: To introduce the students to the basic process of reconstructing traffic crashes, factors involved in traffic crashes, and preparation for presenting reconstructions.

Reference	Ref. No.	Assignment
Introduction to the Traffic Crash Reconstruction	2-1	Study
Process of Traffic Crash Reconstruction	Chapter 1	Read
Causes and Contributing Factors in Traffic Crashes	Chapter 2	Read

MODULE 3 - ENGINEERING MECHANICS

12.5 HOURS

Objective: To teach the students basic statics and dynamics from classical engineering mechanics. To familiarize the students how engineering mechanics relates to crashes. Moments, equations of motion, Newton's three laws of motion, coefficient of friction, drag factor, and other related topics will be discussed.

Reference	Ref. No.	Assignment
Engineering Mechanics - Introduction	3-1	Study
Engineering Mechanics - Statics	3-2	Study
Engineering Mechanics - Dynamics	3-3	Study
Engineering Mechanics Problem - STATEMENTS	3-4	Use
Mathematics and Physics Review for Traffic Crash Reconstruction	Chapter 3	Read
Basic Motion Equations Used in Traffic Crash Reconstruction	Chapter 4	Read
Drag Factor and Coefficient of Friction for Traffic Crash Reconstruction	Chapter 6	Read
Derivations of Equations for Traffic Crash Reconstruction	Chapter 16	Read

MODULE 4 - VEHICLE BEHAVIOR IN COLLISIONS

3.0 HOURS

Objective: The students will understand vehicle motion as a result of a collision and how to determine PDOF. The subjects of vehicle damage and vehicle motion as a result of a collision were covered in Crash Investigation 2. This section is intended primarily as a review.

Reference	Ref. No.	Assignment
Vehicle Behavior In Collisions	4-1	Study
Understanding Vehicle Behavior in Crashes	Chapter 5	Read

MODULE 5 - INTRODUCTION TO HUMAN FACTORS

1.0 HOUR

Objective: To introduce the students to human factors related to traffic crash reconstruction cases.

Reference	Ref. No.	Assignment
Introduction to Human Factors	5-1	Study
Perception and Reaction in Traffic Crashes	Chapter 7	Read

MODULE 6 - TIME-DISTANCE ANALYSIS

3.0 HOURS

Objective: To teach the students how to apply the equations of motion to calculate the time and distance relationships between entities involved in traffic crashes.

Reference	Ref. No.	Assignment
Time-Distance Analysis	6-1	Study
Time-Distance Analysis Problems - STATEMENTS	6-2	Use/Notes
Basic Motion Equations Used in Traffic Crash Reconstruction	Chapter 4	Read

MODULE 7 - COMPREHENSIVE PROBLEMS

5.0 HOURS

Objective: To provide the students with example problems illustrating the week's areas of instruction and the solutions to those problems.

Reference	Ref. No.	Assignment
Comprehensive Problem #1	7-1	Use
Solution to Comprehensive Problem #1	7-2	Use/Notes
Comprehensive Problem #2	7-3	Use
Solution to Comprehensive Problem #2	7-4	Use/Notes

MODULE 8 - CASE STUDIES AND CASE STUDY REVIEW

15.0 HOURS

Objective: To allow the students the opportunity to apply various analytical techniques taught to solving real-world case problems. Cases are reviewed so students can compare their findings with the final solution.

References	Ref. No.	Assignment
Dump Truck v. Car Opposite Direction Crash	8-1	Use
SUV v. Van Opposite Direction Crash - Part 1	8-2	Use
Car v. Van Non-Contact Crash	8-3	Use
SUV v. Van Opposite Direction Crash - Part 2	8-4	Use
Car v. Car Same-Direction Crash	8-5	Use
Car v. Car Intersection Crash	8-6	Use

MODULE 9 - AFTER-IMPACT DRAG FACTOR

7.0 HOURS

Objective: To teach the students how to estimate the after-impact drag factors for vehicles involved in collisions and how to apply the drag factor values to determine the after-impact velocity of the vehicles.

References	Ref. No.	Assignment
After-Impact Drag Factor	9-1	Study
After-Impact Drag Factor Problems - STATEMENTS	9-2	Use
Drag Factor and Coefficient of Friction for Traffic Crash Reconstruction	Chapter 6	Read

MODULE 10 - MOMENTUM

12.5 HOURS

Objective: To teach the students the concept of conservation of linear momentum. To enable the students to understand the data needed to do a momentum analysis, and to how to apply this technique to determine the impact velocities of vehicles involved in crashes.

Reference	Ref. No.	Assignment
Momentum and Collinear Collisions	10-1	Study
Momentum and Oblique Collisions	10-2	Study
Momentum Problems - STATEMENTS	10-3	Use
Momentum Applications in Traffic Crash Reconstruction	Chapter 9	Read

MODULE 11 - PROBLEM SOLUTIONS

0.0 HOURS

Objective: To provide the students with the solutions to the practice problems provided for various areas of instruction.

Reference	Ref. No.	Assignment
Engineering Mechanics Problems - SOLUTIONS	11-3	Use/Notes
Time-Distance Analysis Problems - SOLUTIONS	11-6	Use/Notes
After-Impact Drag Factor Problems - SOLUTIONS	11-9	Use/Notes
Momentum Problems - SOLUTIONS	11-10	Use/Notes

PROBLEM SOLUTIONS, QUIZZES AND FINAL EXAM

19.0 HOURS

Objective: To evaluate overall student comprehension and performance.

Solutions to the topical Problem Statements will be handed in

Two quizzes, two case study quizzes, and two exams will be given.

All quizzes and examinations are timed. All answers must be within a range to be considered correct. No partial credit will be allocated.

Point Values

Answers to Problem Statements**5 Points**

Engineering Mechanics Problems

Time-Distance Analysis Problems

Quiz Week 1**10 Points**

20 Multiple Choice and True/False Questions Worth 0.5 Point Each

Case Study Quiz Week 1**10 Points****Exam Week 1****25 Points****Part 1** - 20 Multiple Choice and True/False Questions 0.5 Point Each**Part 2** - 15 Problems 1 Point Each**First Week Total****50 Points****Answers to Problem Statements****5 Points**

After-Impact Drag Factor Problems

Momentum Problems

Quiz Week 2**10 Points**

20 Multiple Choice and True/False Questions Worth 0.5 Point Each

Case Study Quiz Week 2**10 Points****Exam Week 2****25 Points****Part 1** - 20 Multiple Choice and True/False Questions 0.5 Point Each**Part 2** - 15 Problems 1 Point Each**Second Week Total****50 Points****Course Total****100 points**

TRAFFIC CRASH RECONSTRUCTION 1

Week One

MONDAY

MODULE	TIME	SUBJECT	HOURS
1	8:00 - 9:00	Registration and Orientation	1.0
2	9:00 - 10:00	Introduction to Traffic Crash Reconstruction	1.0
3	10:00 - 12:00	Engineering Mechanics	2.0
3	1:00 - 5:00	Engineering Mechanics	4.0

NOTE: Basic Algebra & Basic Trigonometry in Module 1 will **NOT** be presented in class

TUESDAY

MODULE	TIME	SUBJECT	HOURS
3	8:00 - 11:00	Engineering Mechanics	3.0
4	11:00 - 12:00	Vehicle Behavior in Collisions	1.0
4	1:00 - 3:00	Vehicle Behavior in Collisions	2.0
8	3:00 - 4:00	Case Study 8-1 <i>Dump Truck v. Car Opposite Direction Crash</i>	1.0
8	4:00 - 5:00	Review Case Study 8-1	1.0

WEDNESDAY

MODULE	TIME	SUBJECT	HOURS
8	8:00 - 9:00	Case Study 8-2 <i>SUV v. Van Opposite Direction Crash - Part 1</i>	1.0
8	9:00 - 10:00	Review Case Study 8-2	1.0
3	10:00 - 12:00	Engineering Mechanics	2.0
3	1:00 - 2:30	Engineering Mechanics	1.5
5	2:30 - 3:30	Introduction to Human Factors	1.0
6	3:30 - 4:30	Time -Distance Analysis	1.0
-	4:30 - 5:00	Quiz	0.5

Week One

THURSDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 8:30	Quiz Review	0.5
6	8:30 - 10:30	Time-Distance Analysis	2.0
8	10:30 - 12:00	Case Study 8-3 <i>Car v. Van Non-Contact Crash</i>	1.5
8	1:00 - 2:00	Review Case Study 8-3	1.0
-	2:00 - 5:00	Case Study Quiz 1	3.0

FRIDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 8:30	Review Case Study Quiz 1	0.5
9	8:30 - 10:00	After-Impact Drag Factor	1.5
7	10:00 - 11:00	Comprehensive Problem #1	1.0
7	11:00 - 12:00	Comprehensive Problem #1 Review	1.0
-	1:00 - 5:00	Examination Week 1	4.0

TOTAL HOURS 40.0

TRAFFIC CRASH RECONSTRUCTION 1

Week Two

MONDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 8:30	Review Exam 1	0.5
9	8:30 - 12:00	After-Impact Drag Factor	3.5
9	1:00 - 3:00	After-Impact Drag Factor	2.0
8	3:00 - 4:00	Case Study 8-4 <i>SUV v. Van Opposite Direction Crash - Part 2</i>	1.0
8	4:00 - 5:00	Case Study Review 8-4	1.0

TUESDAY

MODULE	TIME	SUBJECT	HOURS
10	8:00 - 12:00	Collinear Momentum	4.0
10	1:00 - 2:00	Collinear Momentum Problems	1.0
8	2:00 - 4:00	Case Study - 8-5 <i>Car v. Car Same Direction Crash</i>	2.0
8	4:00 - 5:00	Review Case Study - 8-5	1.0

WEDNESDAY

MODULE	TIME	SUBJECT	HOURS
10	8:00 - 12:00	Oblique Momentum	4.0
10	1:00 - 3:00	Oblique Momentum	2.0
10	3:00 - 4:30	Oblique Momentum Problems	1.5
-	4:30 - 5:00	Quiz	0.5

NOTE: Basic Trigonometry in Module 1 will **NOT** be presented in class

Week Two

THURSDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 8:30	Review Quiz	0.5
8	8:30 - 11:00	Case Study 8-6 <i>Car v. Car Intersection Crash</i>	2.5
8	11:00 - 12:00	Review Case Study 8-6	1.0
-	1:00 - 5:00	Case Study Quiz 2	4.0

FRIDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 9:00	Review Case Study Quiz 2	1.0
7	9:00 - 11:00	Comprehensive Problem #2	2.0
7	11:00 - 12:00	Comprehensive Problem #2 Review	1.0
-	1:00 - 5:00	Examination Week 2	4.0

TOTAL HOURS **40.0**

**NORTHWESTERN UNIVERSITY
CENTER FOR PUBLIC SAFETY**

Traffic Crash Reconstruction 2

Course Outline & Schedule 1-1

v20-2

TRAFFIC CRASH RECONSTRUCTION 2

Course Content

MODULE	SUBJECT	HOURS
1	Registration and Orientation	1.0
2	Work and Energy	2.0
3	Damage Energy	7.0
4	Energy and Momentum	3.0
5	Force Balance	4.0
6	EDR Data Usage in Traffic Crash Reconstruction	1.5
7	Special Velocity Calculations	4.5
8	Introduction to EDR Data in Heavy Vehicles	2.0
9	Case Studies and Case Study Reviews	16.5
10	Occupant Kinematics	3.5
11	Monte Carlo Analysis	8.0
12	Comprehensive Problems	6.5
13	Problem Solutions	0.0
	Case Quiz and Examination	20.5
<u>TOTAL HOURS</u>		<u>80.0</u>

TRAFFIC CRASH RECONSTRUCTION 2

Course Outline

MODULE 1 - REGISTRATION AND ORIENTATION

1.0 HOUR

Objective: To acquaint the students with course operating procedures, to introduce them to the reference materials, course outline, course schedule and rules for student behavior. To define their responsibilities and obligations as students.

Reference	Ref. No.	Assignment
Course Overview - Outline & Schedule	1-1	Review/Use
Traffic Crash Reconstruction Equations	1-2	Use
Traffic Crash Reconstruction Equations and Variables	1-3	Use
Coefficient of Friction Table	1-4	Use
Vehicle Acceleration Table	1-5	Use
Imperial-Metric Conversions	1-6	Use
Basic Algebra (NOT covered in class)	1-7	Review
Basic Trigonometry (NOT covered in class)	1-8	Review

MODULE 2 - WORK AND ENERGY

2.0 HOURS

Objective: To teach students the concept of work and energy, how energy is dissipated in traffic crashes, and how to use principles of energy to calculate vehicle velocity in traffic crashes.

Reference	Ref. No.	Assignment
Work and Energy	2-1	Study/Use
Work and Energy Problems - STATEMENTS	2-2	Use
Work, Energy, and Speed from Damage in Traffic Crashes	Chapter 10	Read

MODULE 3 - DAMAGE ENERGY

7.0 HOURS

Objective: To teach the students the methodology used to determine a vehicle's impact velocity and the change in velocity a vehicle experiences due to an impact using vehicle damage.

Reference	Ref. No.	Assignment
Damage Energy	3-1	Study/Use
Damage Energy Problems - STATEMENTS	3-2	Use
Work, Energy, and Speed from Damage in Traffic Crashes	Chapter 10	Read

MODULE 4 - ENERGY AND MOMENTUM

3.0 HOURS

Objective: To teach the students the methodology used to use a combination of momentum and energy to determine closing velocity and impact velocities.

Reference	Ref. No.	Assignment
Energy and Momentum	4-1	Study/Use
Energy and Momentum Problems - STATEMENTS	4-2	Use
Momentum Applications in Traffic Crash Reconstruction	Chapter 9	Read
Work, Energy, and Speed from Damage in Traffic Crashes	Chapter 10	Read

MODULE 5 - FORCE BALANCE

4.0 HOURS

Objective: To teach the students how to apply the concept of force balance in a collision analysis using vehicle damage.

Reference	Ref. No.	Assignment
Introduction to Force Balance	5-1	Study/Use
Introduction to Force Balance Problems - STATEMENTS	5-2	Use
Work, Energy, and Speed from Damage in Traffic Crashes	Chapter 10	Read

MODULE 6 - EDR DATA USAGE IN TRAFFIC CRASH RECONSTRUCTION

1.5 HOURS

Objective: To introduce the students to how the information from a Event Data Recorder (EDR) can be used in traffic crash reconstruction.

Reference	Ref. No.	Assignment
EDR Data in Traffic Crash Reconstruction	6-1	Study
Use of Event Data Recorders in Light Duty Vehicle Crash Reconstruction	Chapter 19	Read

MODULE 7 - SPECIAL VELOCITY CALCULATIONS

4.5 HOURS

Objective: To teach the students the methodologies used to estimate vehicle velocities using specific equations. Calculating velocities based on fall, flip, vault, and sideslip situations will be discussed.

Reference	Ref. No.	Assignment
Special Velocity Calculations	7-1	Study
Special Velocity Calculations Problems - STATEMENTS	7-2	Use

MODULE 8 - INTRODUCTION TO EDR DATA IN HEAVY VEHICLES

2.0 HOURS

Objective: To introduce the students to the basic capabilities of Event Data Recorder (EDR) data in heavy vehicles.

References	Ref. No.	Assignment
Introduction to EDR Data in Heavy Vehicles	8-1	Use
Event Data Recorders in Commercial Vehicle Crash Reconstruction	Chapter 18	Study

MODULE 9 - CASE STUDIES AND CASE STUDY REVIEW

16.5 HOURS

Objective: To allow the students the opportunity to apply various analytical techniques to solving case problems. Cases are reviewed so students can compare their findings with the final solution.

References	Ref. No.	Assignment
SUV v. Wall Single Vehicle Crash	9-1	Use
SUV v. Van Opposite Direction Crash	9-2	Use
SUV v. Pickup Truck Intersection Crash	9-3	Use
Car Off Bridge Crash	9-4	Use
Truck-Tractor/Semi-Trailer v. Pedestrian Crash	9-5	Use
Car v. Two Parked Vans Crash	9-6	Use

MODULE 10 - OCCUPANT KINEMATICS

3.5 HOURS

Objective: To teach the basics of occupant kinematics related to vehicle motion in an impact and the basics of expected injury patterns based on occupant positions, such that the driver of the vehicle can be determined.

Reference	Ref. No.	Assignment
Occupant Kinematics	10-1	Study/Use
Understanding Occupant Behavior in Vehicle Crashes	Chapter 13	Read

MODULE 11 - MONTE CARLO ANALYSIS

8.0 HOURS

Objective: To teach the use of a Monte Carlo analysis to reach conclusions for the most statistically reliable solution to reconstruction issues. A Monte Carlo analysis will be used for momentum and energy issues.

Reference	Ref. No.	Assignment
Monte Carlo Analysis	11-1	Study/Use

MODULE 12 - COMPREHENSIVE PROBLEMS

6.5 HOURS

Objective: To provide the students with example problems illustrating the week's areas of instruction and the solutions to those problems.

Reference	Ref. No.	Assignment
Comprehensive Problem Week 1	12-1	Use
Solution to Comprehensive Problem Week 1	12-2	Use/Notes
Comprehensive Problem Week 2	12-3	Use
Solution to Comprehensive Problem Week 2	12-4	Use/Notes

MODULE 13 - PROBLEM SOLUTIONS

0.0 HOURS

Objective: To provide the students with practice solving problems in the areas of instruction by applying the concepts taught.

Reference	Ref. No.	Assignment
Work and Energy Problems - SOLUTIONS	13-3	Use
Damage Energy Problems - SOLUTIONS	13-4	Use
Force Balance Problems - SOLUTIONS	13-5	Use
Energy and Momentum Problems - SOLUTIONS	13-7	Use

PROBLEM SOLUTIONS, QUIZZES AND FINAL EXAM

19.0 HOURS

Objective: To evaluate overall student comprehension and performance.

Solutions to the topical Problem Statements will be handed in

Two quizzes, two case study quizzes, and two exams will be given.

All quizzes and examinations are timed. All answers must be within a range to be considered correct. No partial credit will be allocated.

Point Values

Answers to Problem Statements**5 Points**

Work and Energy Problems

Damage Energy Problems

Quiz Week 1**10 Points**

20 Multiple Choice and True/False Questions Worth 0.5 Point Each

Case Study Quiz Week 1**10 Points****Exam Week 1****25 Points****Part 1** - 20 Multiple Choice and True/False Questions 0.5 Point Each**Part 2** - 15 Problems 1 Point Each**First Week Total****50 Points****Answers to Problem Statements****5 Points**

Force Balance Problems

Energy and Momentum Problems

Quiz Week 2**10 Points**

20 Multiple Choice and True/False Questions Worth 0.5 Point Each

Case Study Quiz Week 2**10 Points****Exam Week 2****25 Points****Part 1** - 20 Multiple Choice and True/False Questions 0.5 Point Each**Part 2** - 15 Problems 1 Point Each**Second Week Total****50 Points****Course Total****100 points**

TRAFFIC CRASH RECONSTRUCTION 2

Week One

MONDAY

MODULE	TIME	SUBJECT	HOURS
1	8:00 - 9:00	Registration and Orientation	1.0
2	9:00 - 11:00	Work and Energy	2.0
3	11:00 - 12:00	Damage Energy	1.0
3	1:00 - 5:00	Damage Energy	4.0

TUESDAY

MODULE	TIME	SUBJECT	HOURS
3	8:00 - 10:00	Damage Energy	2.0
12	10:00 - 12:00	Comprehensive Problem	2.0
12	1:00 - 2:00	Comprehensive Problem Review	1.0
9	2:00 - 4:00	Case Study 9-1 <i>SUV v. Wall Single Vehicle Crash</i>	2.0
9	4:00 - 5:00	Review Case Study 9-1	1.0

WEDNESDAY

MODULE	TIME	SUBJECT	HOURS
4	8:00 - 11:00	Energy and Momentum	3.0
5	11:00 - 12:00	Force Balance	1.0
5	1:00 - 4:00	Force Balance	3.0
-	4:00 - 4:30	Quiz	0.5
-	4:30 - 5:00	Quiz Review	0.5

Week One

THURSDAY

MODULE	TIME	SUBJECT	HOURS
9	8:00 - 9:30	Case Study 9-2 <i>Van v. SUV Opposite-Direction Crash</i>	1.5
9	9:30 - 10:30	Review Case Study - 9-2	1.0
6	10:30 - 12:00	EDR Data Usage in Traffic Crash Reconstruction	1.5
-	1:00 - 5:00	Quiz - Case Study	4.0

FRIDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 9:00	Review Case Study Quiz	1.0
9	9:00 - 11:00	Case Study 9-3 <i>SUV v. Pickup Truck Intersection Crash</i>	2.0
9	11:00 - 12:00	Review Case Study - 9-3	1.0
-	1:00 - 5:00	Examination 1	4.0

TRAFFIC CRASH RECONSTRUCTION 2

Week Two

MONDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 9:00	Review Exam 1	1.0
7	9:00 - 12:00	Special Velocity Calculations	3.0
7	1:00 - 2:30	Special Velocity Calculations	1.5
9	2:30 - 4:00	Case Study 9-4 <i>Car Off Bridge Crash</i>	1.5
9	4:00 - 5:00	Review Case Study - 9-4	1.0

TUESDAY

MODULE	TIME	SUBJECT	HOURS
8	8:00 - 10:00	Introduction to EDR Data in Heavy Vehicles	2.0
9	10:00 - 12:00	Case Study 9-5 <i>Truck-Tractor/Semi-trailer v. Pedestrian Crash</i>	2.0
9	1:00 - 2:00	Case Study 9-5 <i>Truck-Tractor/Semi-trailer v. Pedestrian Crash</i>	1.0
9	2:00 - 3:00	Review Case Study - 9-5	1.0
10	3:00 - 4:30	Occupant Kinematics	1.5
-	4:30 - 5:00	Quiz	0.5

Week Two

WEDNESDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 8:30	Review Quiz	0.5
10	8:30 - 10:30	Occupant Kinematics	2.0
9	10:30 - 11:30	Case Study 9-6 <i>Car v. Two Parked Vans Crash</i>	1.0
9	11:30 - 12:00	Review Case Study - 9-6	0.5
11	1:00 - 5:00	Monte Carlo Analysis	4.0

THURSDAY

MODULE	TIME	SUBJECT	HOURS
11	8:00 - 12:00	Monte Carlo Analysis	4.0
-	1:00 - 5:00	Case Study Quiz	4.0

FRIDAY

MODULE	TIME	SUBJECT	HOURS
-	8:00 - 8:30	Review Case Study Quiz	0.5
12	8:30 - 11:00	Comprehensive Problem	2.5
12	11:00 - 12:00	Comprehensive Problem Review	1.0
-	1:00 - 5:00	Examination 2	4.0